

Sulphur Creek Spring Chinook Salmon Population Population Viability Assessment

The Sulphur Creek chinook population (Figure 1) is part of the Snake River Spring/Summer Chinook ESU which has five major population groupings (MPGs), including: Lower Snake River, Grande Ronde / Imnaha, South Fork Salmon River, Middle Fork Salmon River, and the Upper Salmon River group. The ESU contains both spring and summer run chinook. The Bear Valley population is a spring run and is one of nine extant populations in the Middle Fork Salmon River MPG.

The ICTRT classified the Sulphur Creek population as a “basic” population (Table 1) based on historical habitat potential (ICTRT 2005). A chinook population classified as basic has a mean minimum abundance threshold criteria of 500 naturally produced spawners with a sufficient intrinsic productivity to achieve a 5% or less risk of extinction over a 100-year timeframe.

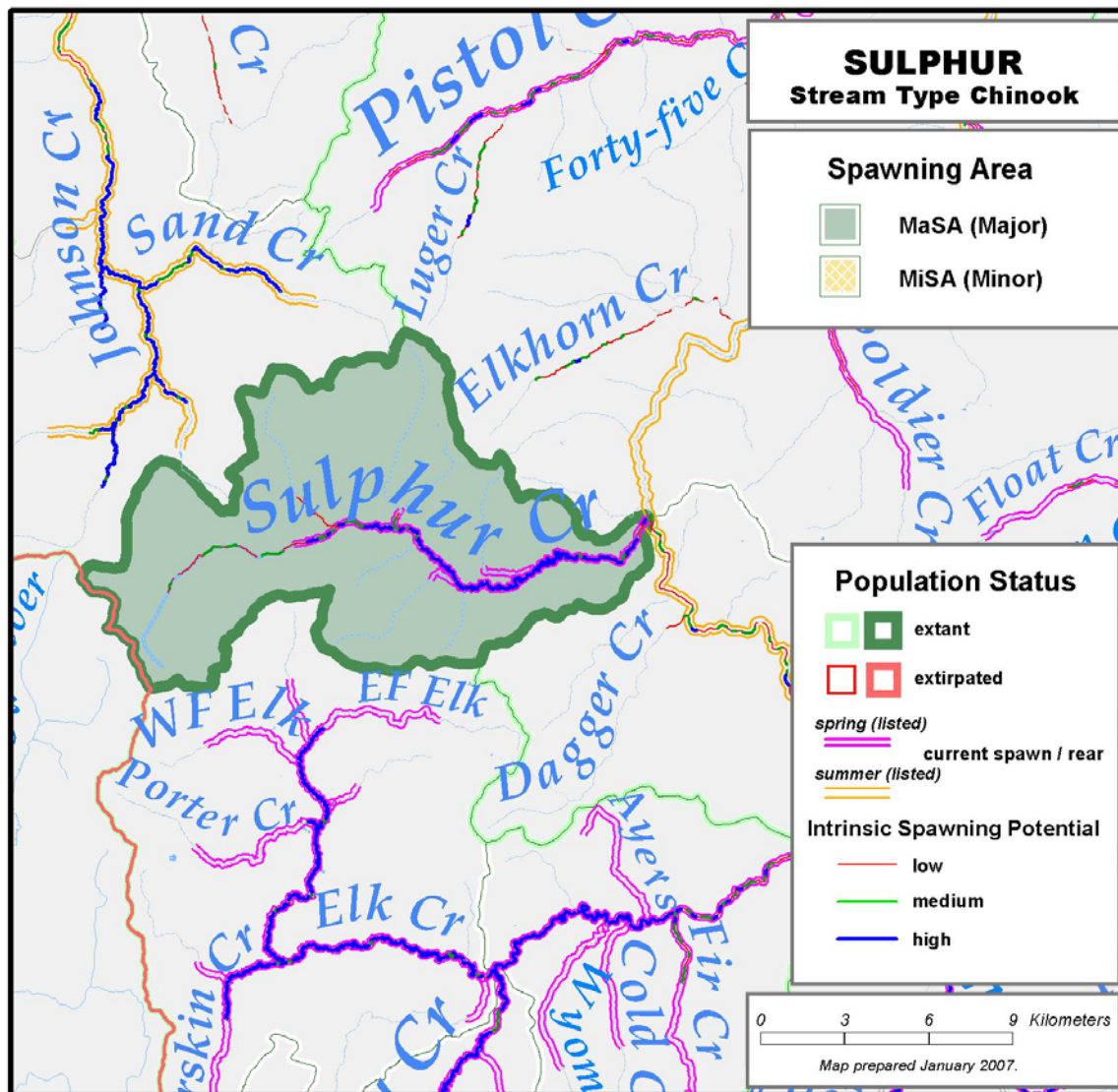


Figure 1. Sulphur Creek chinook major and minor spawning areas.

Table 1. Sulphur Creek chinook basin statistics

Drainage Area (km ²)	133
Stream lengths km* (total)	57
Stream lengths km* (below natural barriers)	54
Branched stream area weighted by intrinsic potential (km ²)	0.113
Branched stream area km ² (weighted and temp. limited)	0.113
Total stream area weighted by intrinsic potential (km ²)	0.125
Total stream area weighted by intrinsic potential (km ²) temp limited	0.125
Size / Complexity category	Basic / A (simple linear)
Number of MaSAs	1
Number of MiSAs	0

*All stream segments greater than or equal to 3.8m bankfull width were included

**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22°C.

Current Abundance and Productivity

Current (1957 to 2003) wild abundance (number of adult spawning in natural production areas) has ranged from no observed redds (1984, 1994, and 1999) to 757 in 1969 (Figure 2).

Abundance estimates are based on expanded redd counts (reference). Insert expansion methodology here

Recent year natural spawners include returns originating from naturally spawning parents, no strays have been observed in the population. Spawners originating from naturally spawning parents have comprised an average of 100%.

Abundance in recent years has been highly variable, the most recent 10-year geomean number of natural origin spawners was 21 (Table 2). During the period 1979-1998,

returns per spawner for steelhead in Sulphur Creek ranged from 0.02 (1990) to 10.33 (1982). The most recent 20 year (1979-1998) SAR adjusted and delimited geometric mean of returns per spawner was 0.92 (Table 2).

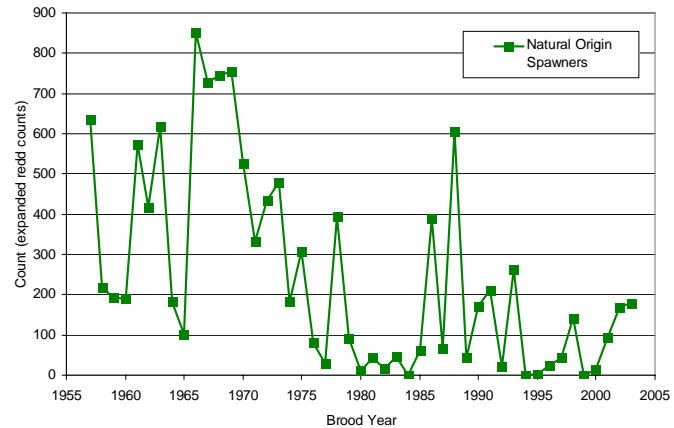


Figure 2. Sulphur Creek escapement estimates 1957-2003.

Table 2. Sulphur Creek abundance and productivity measures

10-year geomean natural abundance	21
20-year return/spawner productivity	0.89
20-year return/spawner productivity, SAR adj. and delimited*	0.92
20-year Bev-Holt fit productivity, SAR adjusted	1.67
20-year Lambda productivity estimate	1.05
Average proportion natural origin spawners (recent 10 years)	100%
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds 75% of the size threshold for this population. This approach attempts to remove density dependence effects that may influence the productivity estimate.

Comparison to the Viability Curve

- Abundance: 10-yr geomean natural origin spawners
- Productivity: 20-yr geomean R/S (adjusted for marine survival and delimited at 375 spawners)
- Curve: Hockey-Stick curve
- Conclusion: The Sulphur Creek Spring Chinook population is at **HIGH** risk based on current abundance and productivity. The point estimate and error bars reside below the 25% risk curve (Figure 3).

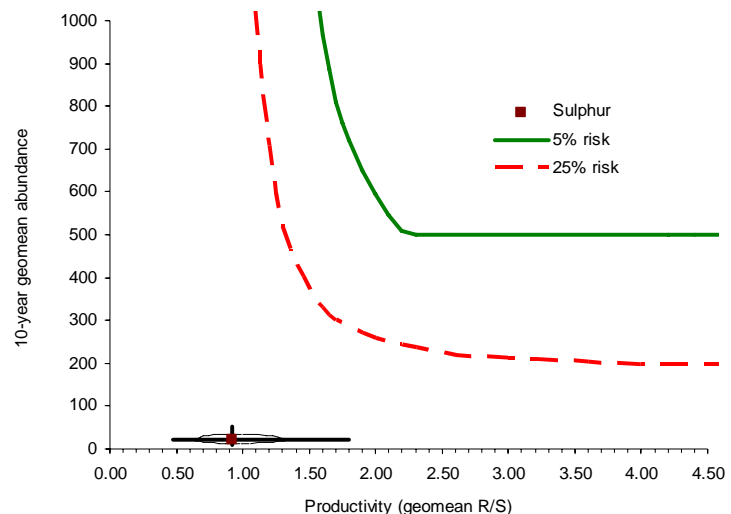


Figure 3. Sulphur Creek Spring Chinook abundance and productivity metrics against a Hockey-Stick viability curve. Estimate includes a 1 SE ellipse, 1.83 X SE abundance line, and 1.86 X SE productivity line.

Spatial Structure and Diversity

The ICTRT has identified one major spawning area (MaSA) and no minor spawning areas (MiSAs) within the Sulphur Creek Spring Chinook population. The MaSA has no modeled temperature limitations. All spawning occurs in Sulphur Creek itself, with little spawning occurring in the lower one (approximate) mile.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas.

The Sulphur Creek population of spring Chinook has one MaSA (Sulphur) and no MiSAs. It is occupied at both the lower and upper ends. The total branched stream area weighted by intrinsic potential is 112,990 m². This metric is rated *High Risk* because there is only one MaSA.

A.1.b. Spatial extent or range of population.

The IDFG has conducted annual spawner index counts since 1957 in Sulphur Creek on approximately 3 miles of the stream. Since 1995 researchers from the USFS-Rocky Mountain Research Station have been surveying all potential spawning habitat in the basin. This metric is rated *Very Low Risk* because current spawning distribution mirrors historical and the historical range has not been reduced. The MaSA is occupied at both the lower and upper ends based on recent spawner surveys.

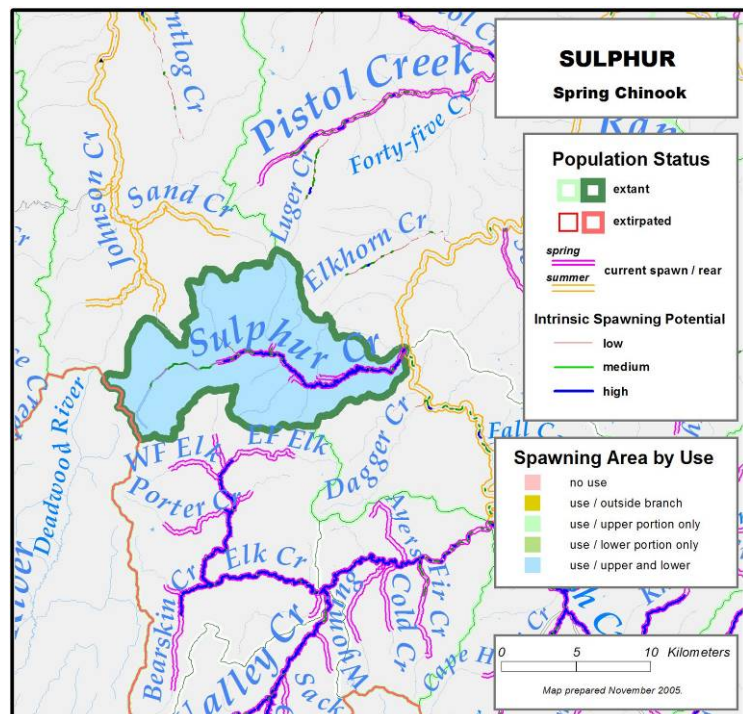


Figure 4. Sulphur Creek Spring Chinook distribution.

A.1.c. Increase or decrease in gaps or continuities between spawning areas.

There has been no change in gaps when comparing current and historical spawning distribution. The population is rated at *Low* risk because the historical MaSA is occupied, gap distance and continuity have not changed, and there has been no increase in distance between this population and other populations in the MPG or ESU. This metric cannot achieve a *Very Low* risk rating because there are not three or more historic MaSAs.

B.1.a. Major life history strategies.

There are limited data to allow any comparisons between historic and current life history strategies. The IDFG classifies adult spawners as spring run. The known major juvenile life history strategy is a spring yearling migrant. No natural or anthropogenic impacts that could have resulted in loss of a life history strategy are known to have occurred. It appears all historic juvenile and adult life history strategies are present, but because data is limited the metric is rated *Low Risk*.

B.1.b. Phenotypic variation.

There is no data to indicate that any phenotypic traits have been significantly changed or lost. No alterations of within-basin habitat conditions that could have resulted in loss of a phenotypic trait are known to have occurred. No major selective pressures exist which would cause significant changes in or loss of traits. Changes in the mainstem migration corridor (lower Snake and Columbia rivers) likely have altered timing of juvenile downstream passage and adult upstream passage. Because smolt entry into the estuary is substantially delayed relative to historic conditions, this metric is rated at *Low Risk*.

B.1.c. Genetic variation.

Genetic ratings were based on IC-TRT analysis of allozyme data presented in Waples et al. 1993. In addition, the IC-TRT analyzed WDFW and R. Waples, unpublished allozyme data, and P. Moran, unpublished microsatellite data. There is no data for assessing genetic variation, and this metric was tentatively rated *Moderate Risk*.

B.2.a. Spawner composition.

Spawner composition is determined from spawning ground carcass recoveries. Any marked fish that are recovered are examined for the presence of a coded-wire or PIT tag. The entire Middle Fork Salmon River MPG is managed by the IDFG as a wild production area with no hatchery intervention. While carcass surveys have been conducted annually in many of the core spawning areas in the MPG, extremely few hatchery strays have been documented. Assessment of this metric is restricted to the observation of only hatchery strays.

(1) *Out-of-ESU strays*. No out-of-ESU strays have been detected spawning in the population and this metric is rated *Very Low risk*.

(2) *Out-of-MPG strays from within the ESU*. Potential out-of-MPG fish that could stray into this population would originate from hatcheries in the downstream South Fork Salmon River MPG or upstream Upper Salmon River MPG. An exhaustive review of all spawner carcass data has not been completed however, it is possible that one or two hatchery strays were present in the population across all survey years. The occurrence of that small number of strays is not suspected of increasing risk to the population and this metric is rated *Very Low risk*.

(3) *Out of population within MPG strays*. There is no within-MPG hatchery program, and this metric is rated *Very Low Risk*.

(4) *Within-population hatchery spawners*. There is no within population hatchery program, and this metric is rated *Very Low risk*.

The overall risk rating for metric B.2.a “spawner composition” is *Very Low Risk* since the population and entire MPG are managed for wild production and essentially no hatchery strays have been observed spawning in the population.

B.3.a. Distribution of population across habitat types.

The Sulphur Creek population intrinsic potential habitat historically was distributed across one EPA level IV ecoregion (Southern Forested Mountains – 100%). There are no substantial changes in ecoregion occupancy and this metric was rated *Low Risk* for the population.

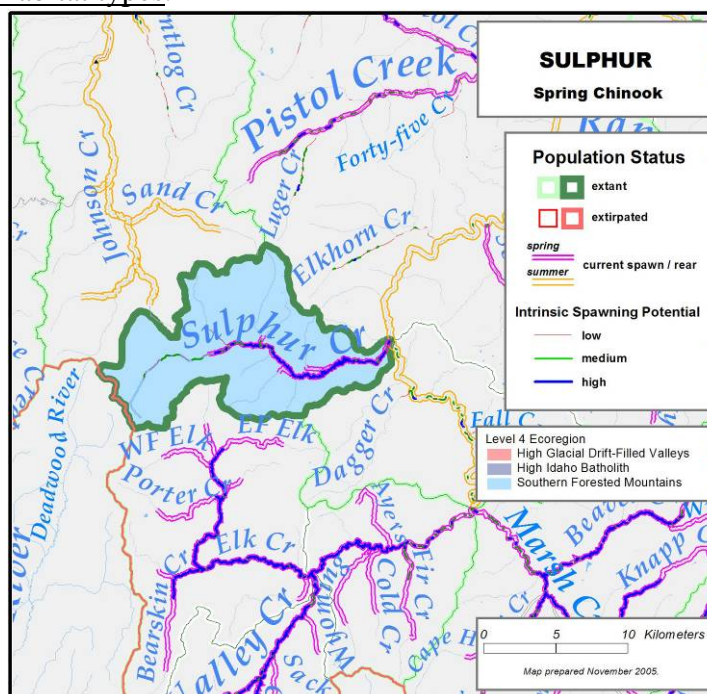


Figure 5. Sulphur Creek Spring chinook population distribution across various ecoregions.

Table 3. Sulphur Creek Spring Chinook—proportion of spawning areas across various ecoregions.

Ecoregion	% of historical spawning area in this ecoregion (non-temperature limited)	% of historical spawning area in this ecoregion (temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Southern forested Mountains	100.0	100.0	100.0

B.4.a. Selective change in natural processes or selective impacts.

Hydropower system: The hydrosystem and associated reservoirs impose some selective mortality on smolt outmigrants and adult migrants, the selective mortality is not likely to remove more than 25% of the affected individuals. The likely impacts are rated as *Low Risk* for this action.

Harvest: Recent harvest rates for spring/summer Chinook salmon are generally less than 10% annually. There are no freshwater fisheries directly targeting wild spring/summer Chinook salmon; indirect mortalities are expected to occur in some fisheries selective for hatchery fish. It is not likely that the incidental mortality is selective for a particular group of fish or if it is, it would not select 25% or more of that particular group, therefore this action was rated as *Very Low risk*.

Hatcheries: The proportion of hatchery strays has always been estimated as 0%. This selective impact was rated *Very Low Risk*.

Habitat: Habitat changes resulting from natural events or anthropogenic impacts may impose some selective mortality, but the extent is unknown. Habitat in the basin has been impacted by grazing activities, water diversions on tributary streams and naturally occurring forest fires. It is likely that any selective mortality imposed as a result of habitat alterations in the basin would impact a non-negligible portion of the population. This selective impact was rated *Very Low Risk*.

Spatial Structure and Diversity Summary

Overall spatial structure and diversity has been rated *Moderate Risk* for the Sulphur Creek population (Table 4). The *Moderate* risk rating assigned to this population is driven by the genetic variation score (metric B.1.c.) which in turn is influenced by a lack of data. It is very possible the actual risk for the genetic variation metric is Low or Very Low, and the population's overall spatial structure/diversity risk is Low.

Table 4. Spatial structure and diversity scoring table

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	H (-1)	H (-1)	Low Risk (Mean=0.67)	Low Risk	Moderate Risk
A.1.b	VL (2)	VL (2)			
A.1.c	L (1)	L (1)			
B.1.a	L (1)	L (1)	Moderate Risk	Moderate Risk	
B.1.b	L (1)	L (1)			
B.1.c	M (0)	M (0)			
B.2.a(1)	VL (2)	Very Low (2)	Very Low (2)		
B.2.a(2)	VL (2)				
B.2.a(3)	VL (2)				
B.2.a(4)	VL (2)				
B.3.a	L (1)	L (1)	Low Risk		
B.4.a	L (1)	L (1)	Low Risk		

Overall Viability Rating

The Sulphur Creek Spring Chinook salmon population does not currently meet viability criteria because Abundance/Productivity risk is high (Table 5). The 20-year delimited recruit per spawner point estimate (1.33) is slightly greater than replacement and substantially less than the 1.9 required at the minimum threshold abundance. The 10-year geometric mean abundance is only 4% of the minimum threshold abundance. Improvement in abundance/productivity status (reduction of risk level) will need to occur before the population can be considered viable. Also,

the population currently does not meet the criteria for a “maintained” population, but has the potential to achieve the Highly Viable status pending resolution of data on genetic variation.

		Spatial Structure/Diversity Risk			
		Very Low	Low	Moderate	High
Abundance/ Productivity Risk	Very Low (<1%)	HV	HV	V	M
	Low (1-5%)	V	V	V	M
	Moderate (6 – 25%)	M	M	M	
	High (>25%)			Sulphur Creek	

Figure 6. Viable Salmonid Population parameter risk ratings for the Sulphur Creek Spring Chinook salmon population. This population does not currently meet viability criteria. Viability Key: HV – Highly Viable; V – Viable; M – Maintained; Shaded cells-- not meeting viability criteria (darkest cells are at greatest risk)

Sulphur Creek Spring Chinook – Data Summary

Data type: Redd count expansions (Cooney)

SAR: Averaged Williams/CSS series

Table 5. Sulphur Creek Spring Chinook run data (used for curve fits and R/S analysis). Data used in the productivity calculation are **bolded**.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtms	R/S	Rel. SAR	Adj. Rtms	Adj. R/S
1979	90	1.00	90	15	0.17	0.87	13	0.15
1980	11	1.00	11	40	3.51	0.58	23	2.05
1981	43	1.00	43	265	6.13	0.63	166	3.85
1982	17	1.00	17	175	10.33	0.51	90	5.28
1983	45	1.00	45	566	12.51	0.58	326	7.21
1984	0	1.00	0	111				
1985	62	1.00	62	106	1.72	1.57	167	2.71
1986	388	1.00	388	236	0.61	1.41	333	0.86
1987	68	1.00	68	63	0.94	1.83	116	1.71
1988	606	1.00	606	240	0.40	0.75	179	0.30
1989	43	1.00	43	40	0.92	1.79	71	1.65
1990	172	1.00	172	3	0.02	4.65	16	0.09
1991	213	1.00	213	8	0.04	3.01	25	0.12
1992	21	1.00	21	35	1.63	1.65	57	2.69
1993	264	1.00	264	147	0.56	1.61	236	0.90
1994	0	1.00	0	8				
1995	4	1.00	4	1	0.21	0.60	1	0.13
1996	23	1.00	23	15	0.65	0.54	8	0.35
1997	42	1.00	42	166	3.95	0.30	49	1.17
1998	141	1.00	141	268	1.90	0.30	79	0.57
1999	0	1.00	0					
2000	13	1.00	13					
2001	95	1.00	95					
2002	169	1.00	169					
2003	178	1.00	178					

Table 6. Geomean abundance and productivity measures. Current abundance and productivity values are boxed.

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
	median	75% threshold	median	75% threshold	1987-1998	1979-1998	geomean
delimited	1.92	0.96	1.33	0.92	0.95	1.05	21
Point Est.	0.46	0.46	0.44	0.36	0.21	0.39	0.49
Std. Err.	8	16	8	16	12	20	9
count							

Table 7. Poptools stock-recruitment curve fit parameter estimates

SR Model	Not adjusted for SAR							Adjusted for SAR						
	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	0.89	0.36	n/a	n/a	2.24	0.48	75.2	0.86	0.27	n/a	n/a	1.63	0.31	66.4
Const. Rec	55	22	n/a	n/a	n/a	n/a	74.7	53	19	n/a	n/a	n/a	n/a	72.0
Bev-Holt	2.77	2.25	104	64	1.80	0.46	73.7	1.67	0.90	160	111	1.25	0.41	66.2
Hock-Stk	1.78	1.02	43	30	1.70	0.44	72.1	0.92	0.30	266	263	1.50	0.37	68.8
Ricker	1.49	0.72	0.00413	0.00242	1.96	0.47	75.4	1.26	0.48	0.00307	0.00190	1.30	0.42	66.9

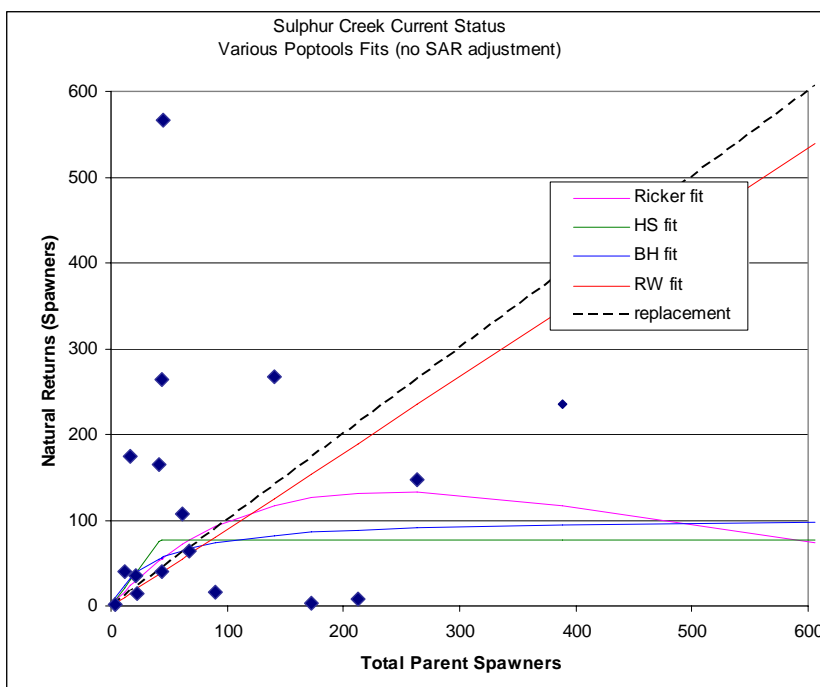


Figure 7. Stock recruitment curves for the Sulphur Creek Spring Chinook population. Data not adjusted for marine survival.

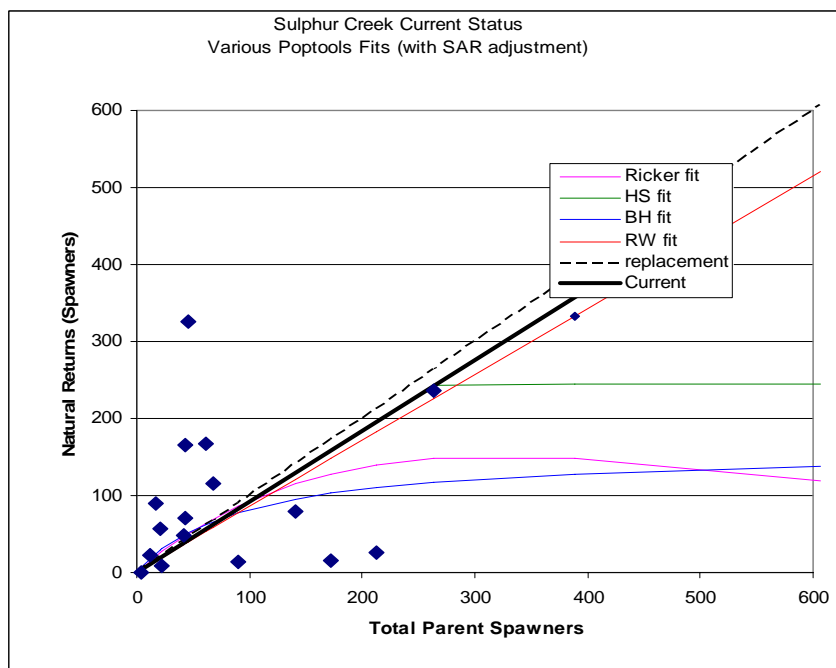


Figure 8. Stock-recruitment curves for the Sulphur Creek Spring Chinook population. Data adjusted for marine survival.